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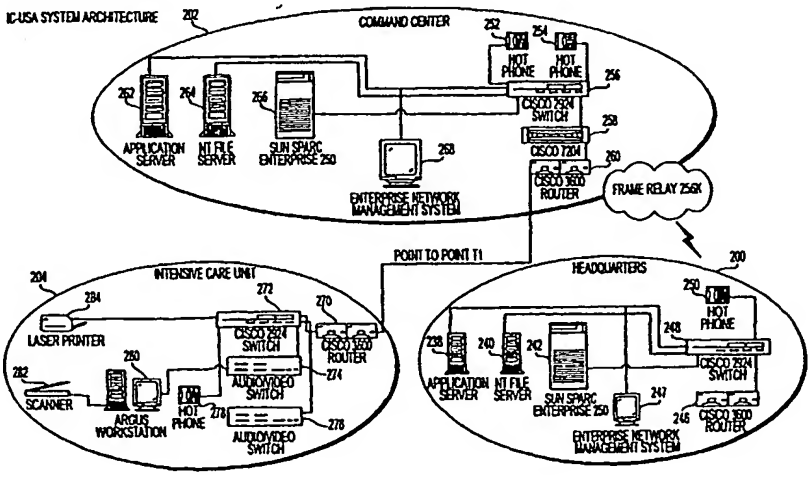
(54) Title: SYSTEM AND METHOD FOR PROVIDING CONTINUOUS, EXPERT NETWORK CRITICAL CARE SERVICES FROM A REMOTE LOCATION(S)




(57) Abstract: A system and method for providing continuous expert network critical care serices from a remote location. A plurality of intensive care units (ICU's) with associated patient monitoring instrumentation is connected over a network to a command center which is manned by intensivists 24 hours a day, 7 days a week. The intensivists are prompted to provide critical care by a standardized series of guideline algorithms for treating a variety of critical care conditions. Intensivists monitor the progress of individual patients at remote intensive care units. A smart alarm system provides alarms to the intensivists to alert the intensivists to potential patient problems so that intervention can occur in a timely fashion. A data storage/data warehouse function analyzes individual patient information from a plurality of command centers and provides updated algorithms and critical care support to the

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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**Title: System and Method for Providing Continuous, Expert Network Critical Care Services from a Remote Location(s)**

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

This invention relates generally to the care of patients in Intensive Care Units (ICUs). More particularly this invention is a system and method for care of the critically ill that combines a real-time, multi-node telemedicine network and an integrated, computerized patient care management system to enable specially-trained Intensivists to provide 24-hour/7-day-per-week patient monitoring and management to multiple, geographically dispersed ICUs from both on-site and remote locations.

### 2. Background Art

While the severity of illness of ICU patients over the past 15 years has increased dramatically, the level of and type of physician coverage in most ICUs has remained constant. Most ICU patients receive brief minutes of attention during morning rounds from physicians with limited critical care experience. During the remainder of the day and night, nurses are the primary caregivers, with specialists called only after patient conditions have started to deteriorate. The result of this mismatch between severity of illness and physician coverage is an unacceptably high ICU mortality rate (10% nationwide), and a high prevalence of avoidable errors that result in clinical complications. In 1998, an Institute of Medicine Roundtable determined that avoidable patient complications were the single largest problem in medical care delivery. In another prominent 1998 study of 1000 patients, 46% experienced an avoidable adverse event in care, with 40% of these errors resulting in serious disability or death.

The physicians who can remedy this situation are in critically short supply. Numerous studies have shown that Intensivists (physicians who have trained and board certified in Critical Care Medicine) can markedly improve patient outcomes. However, only one-third of all ICU patients ever has an Intensivist involved in their care, and the number of Intensivists would need to increase tenfold (nationally) to provide 24-hour

coverage to all ICU patients. With the rapid aging of the population, this shortfall of expertise is going to increase dramatically.

Even where Intensivists are present (and especially where they are not), patients suffer from unnecessary variation in practice. There is little incentive for physicians to develop and conform to evidence-based best practices (it takes significant work and a change in behavior to develop and implement them). This variation contributes to sub-optimal outcomes, in both the quality and cost of care delivered to ICU patients.

What is needed is a redesigning of the critical care regimen offered to patients in an ICU. Rather than the consultative model where a periodic visit takes place and the doctor then goes away, a more active 24-hour intensivist managed care is required. Further, technology that leverages the intensivists' expertise and standardizes the care afforded to patients in an ICU is required. Further, continuous feedback to improve the practice of intensivists in an ICU is necessary to provide the intervention required to minimize adverse events. This invention seeks to provide new methods for managing and delivering care to the critically ill.

Attempts to automate various aspects of patient care have been the subject of various inventions. For example, U.S. Patent No. 5,868,669 to Iliff was issued for "Computerized Medical Diagnostic and Treatment Advice System." The disclosed invention is for a system and method for providing computerized knowledge based medical diagnostic and treatment advice to the general public over a telephone network.

U.S. Patent No. 5,823,948 to Ross, Jr. et al was issued for "Medical Records Documentation, Tracking and Order Entry System". The disclosed invention is for a system and method that computerizes medical records, documentation, tracking and order entries. A teleconferencing system is employed to allow patient and medical personnel to communicate with each other. A video system can be employed to videotape a patient's consent.

U.S. Patent No. 4,878,175 to Norden-Paul et al. was issued for "Method for Generating Patient-Specific Flowsheets By Adding/Deleting Parameters." The disclosed invention is for an automated clinical records system for automated entry of bedside equipment results, such as an EKG monitor, respirator, etc. The system allows for information to be entered at the bedside using a terminal having input means and a video display.

U.S. Patent No. 5,544,649 to David et al. was issued for "Ambulatory Patient Health Monitoring Techniques Utilizing Interactive Visual Communications." The disclosed invention is for an interactive visual system, which allows monitoring of patients at remote sites, such as the patient's home. Electronic equipment and sensors are used at the remote site to obtain data from the patient, which is sent to the monitoring site. The monitoring site can display and save the video, audio and patient's data.

U.S. Patent No. 5,867,821 to Ballantyne et al. was issued for "Method and Apparatus for Electronically Accessing and Distributing Personal Health Care Information and Services in Hospitals and Homes." The disclosed invention is for an automated system and method for distribution and administration of medical services, entertainment services, and electronic health records for health care facilities.

U.S. Patent No. 5,832,450 to Myers et al. issued for "Electronic Medical Record Using Text Database." The disclosed invention is for an electronic medical record system, which stores data about patient encounters arising from a content generator in freeform text.

U.S. Patent No. 5,812,983 to Kumagai was issued for "Computer Medical File and Chart System." The disclosed invention is for a system and method which integrates and displays medical data in which a computer program links a flow sheet of a medical record to medical charts.

U.S. Patent No. 4,489,387 to Lamb et al. was issued for "Method and Apparatus for Coordinating Medical Procedures." The disclosed invention is for a method and apparatus that coordinates two or more medical teams to evaluate and treat a patient at the same time without repeating the same steps.

U.S. Patent No. 4,731,725 to Suto et al. issued for "Data Processing System which Suggests a Pattern of Medical Tests to Reduce the Number of Tests Necessary to Confirm or Deny a Diagnosis." The disclosed invention is for a data processing system that uses decision trees for diagnosing a patient's symptoms to confirm or deny the patient's ailment.

U.S. Patent No. 5,255,187 to Sorensen issued for "Computer Aided Medical Diagnostic Method and Apparatus." The disclosed invention is for an interactive computerized diagnostic system which relies on color codes which signify the presence or

absence of the possibility of a disease based on the symptoms a physician provides the system.

U.S. Patent No. 5,839,438 to Chen et al. issued for "Intelligent Remote Visual Monitoring System for Home Health Care Service." The disclosed invention is for a computer-based remote visual monitoring system, which provides in-home patient health care from a remote location via ordinary telephone lines.

U.S. Patent No. 5,842,978 to Levy was issued for "Supplemental Audio Visual Emergency Reviewing Apparatus and Method." The disclosed invention is for a system which videotapes a patient and superimposes the patient's vital statistics onto the videotape.

While these invention provide useful records management and diagnostic tool, none of them provides a comprehensive method for monitoring and providing real time critical care at disparate ICU's. In short, they are NOT designed for critical care. Further, none of these inventions provide for the care of a full time intensivist backed by appropriate database and decision support assistance in the intensive care environment. What would be useful is a system and method for providing care for the critically ill that maximizes the presence of an intensivist trained in the care of the critically. Further such a system would standardize the care in ICU's at a high level and reduce the mortality rate of patients being cared for in ICU's

## SUMMARY OF THE INVENTION

The present invention provides a core business of Continuous Expert Care Network (CXCN) solution for hospital intensive care units (ICUs). This e-solution uses network, database, and decision support technologies to provide 24-hour connectivity between Intensivists and ICUs. The improved access to clinical information and continuous expert oversight leads to reduced clinical complications, fewer medical errors, reduced mortality, reduced length of stay, and reduced overall cost per case.

The technology of the present invention as explained below can be implemented all at once or in stages. Thus the technology, as more fully explained below is available in separate components to allow for the fact that hospitals may not be able to implement all of the technology at once. Thus modular pieces (e.g. videoconferencing, vital sign monitoring with smart alarms, hand-held physician productivity tools, etc.) can be implemented, all of which can add value in a stand-alone capacity. First amongst these

offerings will be an Intensivist Decision Support System, a stand-alone software application that codifies evidence-based, best practice medicine for 150 common ICU clinical scenarios. These support algorithms are explained more fully below.

The "Command Center" model, again as more fully set forth below, will ultimately give way to a more distributed remote management model where Intensivists and other physicians can access ICU patients and clinicians (voice, video, data) from their office or home. In this scenario, the present invention will be available in hospital applications that centralize ICU information, and offer physicians web-based applications that provide them with real-time connectivity to this information and to the ICUs. This access and connectivity will enable physicians to monitor and care for their patients remotely. These products will be natural extensions and adaptations of the present invention and the existing applications disclosed herein that hose skilled in the art will appreciate and which do not depart from the scope of the invention as disclosed herein.

The present invention addresses these issues and shortcomings of the existing situation in intensive care, and its shortfalls via two major thrusts. First, an integrated video/voice/data network application enables continuous real-time management of ICU patients from a remote setting. Second, a client-server database application B integrated to the remote care network B provides the data analysis, data presentation, productivity tools and expert knowledge base that enables a single Intensivist to manage the care of up to 40 patients simultaneously. The combination of these two thrusts B care management from a remote location and new, technology-enhanced efficiency of Intensivist efforts B allows health care systems to economically raise the standard of care in their ICUs to one of 24x7 continuous Intensivist oversight.

It is therefore an object of the present invention to reduce avoidable complications in an ICU.

It is a further object of the present invention to reduce unexplained variations in resource utilization in an ICU.

It is a further objective of the present invention to mitigate the serious shortage of intensivists.

It is yet another objective of the present invention to reduce the occurrence of adverse events in an ICU.

It is a further objective of the present invention to standardize the care at a high level among ICUs.

It is yet another objective of the present invention to reduce the cost of ICU care.

It is yet another objective of the present invention to dramatically decrease the mortality in an ICU.

It is yet another objective of the present invention to bring information from the ICU to the intensivist, rather than bring the intensivist to the ICU.

It is a further objective of the present invention to combine tele-medical systems comprising two-way audio/video communication with a continuous real time feed of clinical information to enable the intensivist to oversee care within the ICU.

It is a further objective of the present invention to allow intensivists to monitor ICUs from a site remote from each individual ICU.

It is a further objective of the present invention to bring organized detailed clinical information to the intensivist, thereby providing standardized care in the ICU.

It is yet another objective of the present invention to utilize knowledge-based software to use rules, logic, and expertise to provide preliminary analysis and warnings for the intensivists.

It is a still further objective of the present invention to provide a video visitation system that allows persons at remote locations using remote terminals to participate in a video/audio conferencing session with a patient or his/her caregivers local to a patient site.

The present invention comprises a command center/remote location, which is electronically linked to ICUs remote from the command center/remote location. The command center/remote location is manned by intensivists 24 hours a day, seven days per week. Each ICU comprises a nurse's station, to which data flows from individual beds in the ICU. Each patient in the ICU is monitored by a video camera, as well as by clinical monitors typical for the intensive care unit. These monitors provide constant real time patient information to the nurse's station, which in turn provides that information over a dedicated T-1 (high bandwidth) line to the ICU command center/remote location. As noted earlier, the command center/remote location is remote from the ICU, thereby allowing the command center/remote location to simultaneously monitor a number of patients in different ICUs remote from the command center/remote location.

At each command center/remote location, video monitors exist so that the intensivist can visually monitor patients within the ICU. Further, the intensivist can steer and zoom the video camera near each patient so that specific views of the patient may be obtained, both up close and generally. Audio links allow intensivists to talk to patients and staff at an ICU bed location and allow those individuals to converse with the intensivist.

Clinical data is constantly monitored and presented to the command center/remote location in real time so that the intensivist can not only monitor the video of the patient but also see the vital signs as transmitted from the bedside. The signals from the clinical data and video data are submitted to a relational database, which comprises 1) standardized guidelines for the care of the critically ill, 2) various algorithms to support the intensive care regimen, 3) order writing software so that knowledge-based recommendations and prescriptions for medication can be made based upon the clinical data, and 4) knowledge-based vital sign/hemodynamic algorithms that key the intensivist to engage in early intervention to minimize adverse events.

The advantage of the present invention is that intensivists see all patients at a plurality of ICU's at all times. Further, there is a continuous proactive intensivist care of all patients within the ICU, thereby minimizing adverse events. Intervention is triggered by evidence-based data-driven feedback to the intensivist so that standardized care can be provided across a plurality of ICUs.

The economic benefits of the present invention are manifold. For the first time, 24-hour a day, seven day a week intensivist care for patients in an ICU can be obtained. Further, more timely interventions in the care of the patients can be created by the knowledge-based guidelines of the present invention, thereby minimizing complications and adverse events. This in turn will lead to a reduced mortality within the ICU, and hence, a reduced liability cost due to the dramatic reduction in avoidable errors in health care.

By providing timely interventions, the length of stay within the ICU can be greatly reduced, thereby allowing more critically ill patients to be cared for in the ICU.

In addition, by reviewing and standardizing the care afforded to patients in an ICU, a more standardized practice across a variety of ICUs can be achieved. This will lead to more cost-effective care within the ICU, and reduced ancillary cost for the care of the critically ill.

The overall architecture of the present invention comprises a "pod." The pod comprises a tele-medicine command center/remote location connected to a plurality multiple ICUs at various locations. The connection between the command center/remote location and the ICUs is via a dedicated wide-area network linking the ICUs to the command center/remote location and a team of intensivists who integrate their services to provide 24-hour, seven day a week care to all of the pod ICUs.

The pod is connected via a wide-area network using dedicated T-1 lines, for example, with redundant backup. This network provides reliable, high speed secure transmission of clinical data and video/audio signals between each patient room and the command center/remote location. The use of a T-1 line is not meant as a limitation. It is expected that more and higher bandwidth networks will become available. Such high bandwidth networks would come within the scope of the invention as well.

Each patient room is equipped with a pan/tilt/zoom video camera with audio and speaker to enable full videoconferencing capability. In addition, computer workstations are dedicated for exclusive physician use in each ICU, preferably at the nurse's station. Intensivists use the workstations to view patient information, consult decision support information, record their notes, and generate patient orders.

The patient management software used by intensivists is provided across the pod. Updates and changes made to the record are available at both the ICU and the command center/remote location for any given patient.

Each command center/remote location contains at least three workstations: one for the intensivist, one for the critical care registered nurse, and one for a clerk/administrative person.

The intensivist workstation comprises separate monitors for displaying ICU video images of patients and/or ICU personnel, output from bedside monitoring equipment, patient clinical data comprising history, notes, lab reports, etc., and decision support information. The staff at the command center/remote location are able to activate and control the cameras in each patient's room so that appropriate visual views of the patient can be generated.

Intensivists are able to switch between rooms and patients and can monitor at least two rooms simultaneously via the video screens. Patient data such as X-ray and ECG

images are scanned and transmitted to the command center/remote location upon request of the intensivist.

Remote patient management is utilized in the present invention's critical care program to supplement traditional onsite care. The rationale underlying the remote patient management of the present invention is that critically ill patients are inherently unstable and require continuous expert care that is not now offered in existing ICU monitoring regimens. Further, remote monitoring allows a single intensivist to care for patients in multiple ICU locations, thereby creating an efficiency that makes continuous care feasible.

Remote intensivist care of the present invention is proactive. Intensivists will order needed therapies and check results of tests and monitor modalities in a more timely fashion than is currently offered. Patients can be observed visually when needed using the ceiling-mounted cameras in each room.

Command center/remote location personnel communicate with ICU staff through videoconferencing and through "hot phones," which are dedicated telephones directly linked between the command center/remote location and the ICU. These communications links are used to discuss patient care issues and to communicate when a new order has been generated.

Intensivists document important events occurring during their shift in progress notes generated on the command center/remote location computer terminal.

Intensivists detect impending problems by intermittently screening patient data, including both real time and continuously stored vital sign data. Patient severity of illness determines the frequency with which each patient's data is reviewed by the intensivists.

A video visitation system allows Remote Visitation Participants (RVPs) at remote terminals to participate in a video/audio conferencing session with a Local Visitation Participant(s) (LVPs) (e.g., the patient or the patient's caregivers) at a patient site.

## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates the logical data structure for billing, insurance and demographic information

Figure 1A illustrates the logical data structure for billing, insurance and demographic information (cont)

Figure 2 illustrates the command center logical data structure

Figure 2A illustrates the command center logical data structure (cont)

Figures 3 illustrates the logical data structure for creating a medical history

Figure 4 illustrates the logical data structure for creating notes relating to patient treatment and diagnosis

Figure 4A illustrates the logical data structure for creating notes relating to patient treatment and diagnosis (cont)

Figure 4B illustrates the logical data structure for creating notes relating to patient treatment and diagnosis (cont)

Figure 5 illustrates the logical data structure for entry of medical orders

Figure 6 illustrates the logical data structure for patient care, laboratory testing and diagnostic imaging

Figure 6A illustrates the logical data structure for patient care, laboratory testing and diagnostic imaging (cont)

Figure 7 illustrates the logical data structure for categories of information that are permitted to be presented to intensivists and other care givers by the system

Figure 8 illustrates the logical data structure for documenting patient vital signs

Figure 8A illustrates the logical data structure for documenting patient vital signs (cont)

Figure 9 illustrates the distributed architecture of the present invention

Figure 10 illustrates the system architecture of the present invention

Figure 11 illustrates the decision support algorithm for decision support algorithm for diagnosis and treatment of pancreatitis.

Figure 12 illustrates the vital signs data flow.

Figure 13A illustrates capture and display of diagnostic imaging.

Figure 13B illustrates establishing videoconferencing in the present invention.

Figure 14 illustrates the physician resources order writing data interface of the present invention.

Figure 15 illustrates the physician resources database data interface of the present invention.

Figure 16 illustrates the automated coding and billing system integrated with the workflow and dataflow of the present invention.

Figure 17 illustrates the order writing data flow of the present invention.

Figure 18 illustrates the event log flow of the present invention.

Figure 19 illustrates the smart alarms implementation of the present invention.

Figure 20 illustrates the procedure note creation and line log for the present invention.

Figure 21 illustrates the acalculous cholecystitis decision support algorithm

Figure 22 illustrates the adrenal insufficiency decision support algorithm

Figure 23 illustrates the blunt cardiac injury decision support algorithm

Figure 24 illustrates the candiduria decision support algorithm

Figure 25 illustrates the cervical spine injury decision support algorithm

Figure 26 illustrates the oliguria decision support algorithm

Figure 26A illustrates the oliguria decision support algorithm (cont)

Figure 26B illustrates the oliguria decision support algorithm (cont)

Figure 27 illustrates the open fractures decision support algorithm

Figure 28 illustrates the pancreatitis decision support algorithm

Figure 29 illustrates the penicillin allergy decision support algorithm

Figure 30 illustrates the post-op hypertension decision support algorithm

Figure 31 illustrates the pulmonary embolism decision support algorithm

Figure 31A illustrates the pulmonary embolism decision support algorithm (cont)

Figure 32 illustrates the seizure decision support algorithm

Figure 33 illustrates the SVT determination decision support algorithm

Figure 33A illustrates the SVT unstable decision support algorithm

Figure 34 illustrates the wide complex QRS Tachycardia decision support algorithm

Figure 34A illustrates the wide complex QRS Tachycardia decision support algorithm (cont)

Figure 35 illustrates the assessment of sedation decision support algorithm

Figure 35A illustrates the assessment of sedation decision support algorithm (cont)

Figure 36 illustrates the bolus sliding scale midazolam decision support algorithm

Figure 37 illustrates the sedation assessment algorithm decision support algorithm

Figure 38 illustrates the short term sedation process decision support algorithm

Figure 39 illustrates the respiratory isolation decision support algorithm

Figure 40 illustrates the empiric meningitis treatment decision support algorithm

Figure 41 illustrates the ventilator weaning decision support algorithm

Figure 41A illustrates the ventilator weaning decision support algorithm (cont)

Figure 42 illustrates the warfarin dosing decision support algorithm

Figure 43 illustrates the HIT-2 diagnostic decision support algorithm

Figure 44 illustrates a video visitation system according to an alternate embodiment of the present invention

**Definitions of Terms and Data**

**Definitions of Modules** In the following Detailed description of the Invention, a number of modules and procedures are described. For purposes of definitions, the following module definitions apply and are more fully amplified in the descriptions of the figures that follow:

Term Definitions:

Following are a series of definitions for certain terms used in this specification:

Insurance carrier: This is a table of all the valid insurance carriers listed in the system of the present invention.

Patient guarantor: Provides the insurance guarantor information for a given patient.

Patient information: Provides demographic information for each patient.

Medical event date history: This contains the various disorders of the patient and the dates associated with major medical events relating to those disorders.

Medical history: Contains non-major system medical history of a patient.

Drug: Contains what medication and allergies have been identified for a patient at admission.

Address: Contains the address or addresses for a given patient.

Patient visit: There may be multiple records for any given patient, since the patient may visit the ICU on more than one occasion. This file contains a record of each visit to an ICU by a patient.

Physician-patient task: Contains the task that had been defined for each patient.

Present illness: This contains a textural description of the patient illness for the specific ICU visit.

Physical exam: This contains the information gathered as a result of a physical examination of the patient during the admission to the ICU.

Surgical fluids: This provides all the information related to the fluids provided during surgery.

Surgery: This contains all information pertaining to any surgical procedure performed on a patient while the patient is at the ICU.

Patient admit: This provides general information that needs to be gathered when a patient is admitted into the ICU.

Medical orders: This provides the general information for all types of medical orders associated with a given patient.

Daily treatment: This contains the treatment provided for a given patient on a given day.

Daily diagnosis: This contains the daily diagnosis for a given patient, which includes neurological, cardiological, pulmonary, renal, endocrinological, and any other diagnosis that may be associated with a patient.

Vital sign information is also critical to the administration of care in the ICU. A number of different modules collect information relating to patient vital signs. For example:

Patient admit: This provides the general information that needs to be gathered when a patient is admitted to the ICU.

Patient visit: This contains a record of each visit to an ICU by a patient.

Patient: Provides demographic information for each patient.

Vital sign header: This contains general information related to the vital sign data for the particular patient.

Vital sign: Contains the vital sign data taken at specific intervals for a given patient.

Hospital: This contains identifying information for a particular hospital where the care is given.

ICU bed: Contains the association for identifying which beds are in a given ICU.

Command center/remote location definitions and modules have also been created for the present invention to allow for the orderly storage and retrieval and entering of data. For example:

Physician-physician (such as nurses and LPN and the like): Contains the names of all of the physicians and physician extenders for the command center/remote location as well as for ICUs associated with the command center/remote location.

Communication: Contains all of the various types of communication vehicles used to contact an individual physician or physician extender.

Physician role: Contains the role a physician is playing for a given patient, (i.e., primary care, consultant, etc.)

Patient: Provides demographic information for each patient.

Command center/remote location: Provides identifying information for a particular command center/remote location.

Hospital: Contains identifying information for a particular hospital wherein an ICU is located.

ICU: Contains identifying information for an ICU at a hospital.

ICU bed: Contains the association for identifying which beds are in a given hospital.

ICU patient location: Provides the association between an ICU and a patient and identifies where a patient is located within an ICU in a particular hospital.

The order entry functionality of the present invention provides a critical service for obtaining information on the patient during admission, medical orders, and procedures provided to the patient during the ICU stay. For example:

Radiology: Contains all radiology performed on a particular patient.

Radiology results: Contains the results of each radiology test performed on the particular patient.

Drugs: Contains all relevant information for all the drugs that a patient has been administered.

Laboratory: Contains all laboratory tests ordered for a patient.

Microbiology result: Contains the results of microbiology organisms taken on a patient.

Laboratory result: Contains the results for a laboratory test ordered for a particular patient.

## DETAILED DESCRIPTION OF THE INVENTION

The present invention is a system and method for remote monitoring of ICU's from a distant command center/remote location. By monitoring a plurality of ICU's remotely, intensivists can better spread their expertise over more ICU beds that heretofore

achievable. The presence of 24-hour a day/7 day-per-week intensivist care dramatically decreases the mortality rates associated with ICU care.

Referring to Figures 1 and 1A, the Billing and Demographic data structure of the present invention is illustrated. Patient demographic information **9010** is collected on the particular patient. This information comprises all the typical kinds of information one would normally gather on a patient such as first name, last name, telephone number, marital status, and other types of information. Patient insurance information **9012** is collected and associated with the patient demographic information **9010.** Patient insurance information **9012** relates to information on the type of accident and related information such as employment, employer name, place of service, and other information that would relate to the accident that actually occurred (if at all) and which would have to be reported to an insurance agency. This information is associated with the patient demographic information which assigns the unique patient ID to the particular patient.

Insurance plan information **9008** is also created and stored and comprises insurance carrier ID's, the plan name, policy number, and group number. This information on the insurance plan **9008** is also associated with the patient ID and demographic information **9010.**

Physician information **9002** is also created and stored for each physician associated with the system of the present invention. Information such as first and last name, credentials, and other information concerning the physician is saved. In addition, the physician's role is identified **9004** and information concerning the physician and the physician's role is associated with the particular patient via the patient ID stored in the demographic information **9010.**

Patient's are entered into the hospital by a hospital representative **9006** who has a representative ID which also is ultimately associated with the patient ID. In addition, communications data **9000** is stored concerning how a representative can be reached (cell phone, home phone etc.).

Referring now to Figure 1A, the Overall Billing and Insurance data structure is illustrated. An insurance provider number **9014** is also stored in the system. Each physician is given a provider number and provider ID by each insurance company. Thus data must be stored regarding the ID that is given to a particular physician by each insurance provider. This information is also stored and can be associated ultimately with

treatment of the patient.

Each patient admitted to the hospital and to the ICU has a patient visit ID associated with the patient **9017.** This visit ID has patient ID information, ICU information, admission date, and other information relevant to the specific visit. This information is illustrated in Figure 1A. The visit ID **9017** is associated with the patient ID **9010** so that each visit can be tracked by patient.

Insurance carrier information **9018** is stored by the system and is associated with the insurance plan information **9008** as appropriate. Thus the particular insurance carrier with its name, address, and other identifying information **9018** is associated with the type of plan **9008** carried by the patient. The insurance carrier information **9018** together with the insurance plan information **9008** is associated with the patient via the patient ID information **9010.**

Patient address information **9020** and **9022** are collected for each individual patient and associated with the patient demographic information **9010.** If there is a patient guarantor, this information is obtained and stored with information on the guarantor **9026.** Such information as the guarantor's first and last name, date of birth, and other information is stored and is illustrated in Figure 1A. Further, the guarantor's address **9024** is also collected and ultimately associated with the patient demographic information **9010.**

Referring to Figures 2 and 2A, the Command Center logical data structure is illustrated.

The various information associated with demographic and insurance information is again used to manage the care and operations of the command center. Therefore, communications information **9000** is combined with physician and physician extender (i.e. nurse, LPN and the like) information **9002** and physician role **9004** to be associated with the demographic information **9010.** The patient visit information **9017** together with this information is associated with the patient's location which has a unique identifier **9030.** Each location ID has patient ID information and visit ID information associated with it.

Referring now to Figure 2A, the Command Center logical data structure illustration continues. Each ICU bed has an associated location ID which comprises hospital ICU information, room number, and bed number **9038.** In addition, and as described earlier, instrumentation such as cameras are also associated with the particular patient. Therefore the camera setting **9040** will have a location ID relating to the ICU bed

as well as have camera value settings and associated camera identifier information.

Each ICU bed **9038** is associated with an ICU **9032.** Each ICU has information associated with it that uniquely identifies the ICU as being associated with the particular hospital, and having particular phone numbers, fax numbers, work space addresses, and other information, that help to identify the ICU.

As noted above, each ICU is associated with a hospital **9034.** Each hospital has a unique identifier, as well as its own name, address, and other identifying information. Further, since each hospital ICU is to be coordinated through a remote command center, information on the remote command center **9036** is associated with the hospital information. Each command center has a unique ID and has associated address information stored as well.

Thus in the Command Center logical data structure, patient ID information **9010** is linked to a patient location **9030** which in turn is associated with an ICU bed **9038** each of which beds are uniquely associated an ICU **9032** which is associated with a hospital **9034** which in turn has the ICU managed by a command center **9036.**

An integral part of the system of the present invention is the recording of medical history. Referring to Figure 3, the logical relationship among data elements for medial history is illustrated. Patient visit information **9017** combined with the physician-physician extender information **9002** is combined with specific note-taking information **9042.** The note information comprises the date and time the notes are taken as well as the note type. The note ID is fed information from the medical history item **9044,** which has its own unique medical ID associated with it. This information comprises medical text, category of information, and other information relevant to the medical history. As noted, this information for medical history **9044** is associated with a note ID **9042,** which in turn is associated with the patient visit and physician information **9017** and **9002.**

Referring to Figure 4, 4A, and 4B, the note-keeping logical data structure of the present invention is illustrated. As noted earlier, the note ID **9042** combines information from visit ID, treating physician, and other information relating to the time the note was entered. Other information is associated with the note ID. Referring first to Figure 4, the patient visit information **9017,** is associated with the note ID **9042.** Various procedural information **9046** is kept by the system of the present invention and is associated with the visit ID **9017.** Physicians are able to create free text patient illness notations **9048** and

associate them with the note **9042**. Similarly, free text information regarding functioning of the system **9050** is permitted and also associated with notes regarding the particular patient and procedure **9042**.

Specific notes regarding, for example, surgical procedures are also kept. Surgery notes **9054** are associated with a particular note ID and have such information as anesthesia, surgical diagnosis, elective information, and other related surgical information. Surgical fluids **9052** administered during the course of surgery are associated with the surgery information **9054**. Additionally, any surgical complications **9056** are noted and also associated with the surgery which in turn has an associated note ID.

Referring now to Figure 4A, the logical data structure for notes and its description is continued. An assessment plan **9058** is created and associated with the same note ID for the particular patient. The plan has a free text field that allows a physician to create the appropriate assessment plan and associate it with a note ID **9042**.

Various daily notes are also kept and associated with the individual note ID **9042**. For example, the daily mental state **9060** is recorded to document the mental state of the patient. The daily treatment **9062** administered to the patient is associated with the unique note ID. The daily diagnosis **9068** is also created and associated with unique note ID **9042**.

Any unstable conditions are also noted **9070** and records kept of those conditions. Similarly mortality performance measures (MPM) information **9072** is kept and associated with the unique note ID. To the extent that any physical exam **9074** is administered, that physical exam and any free text created by the physician is associated with the unique ID and records kept. Allergy information **9076** for the particular patient is also created and stored along with the allergy type, and allergy name. This information is uniquely associated with the note ID. Referring now to Figure 4B, the Logical Data Structure for the Notes Creation and Storage description is continued. A specific note item record **9078** is also kept and associated with unique note ID. This note item comprises the principal diagnosis, the chief complaint, the past history of the patient, the reason for the note, and various other identifications and flags of information which help in documenting the patient's condition.

Any drugs that are administered to the patient, including dosage, type, and number **9086** is kept and associated with the unique note ID **9042**.

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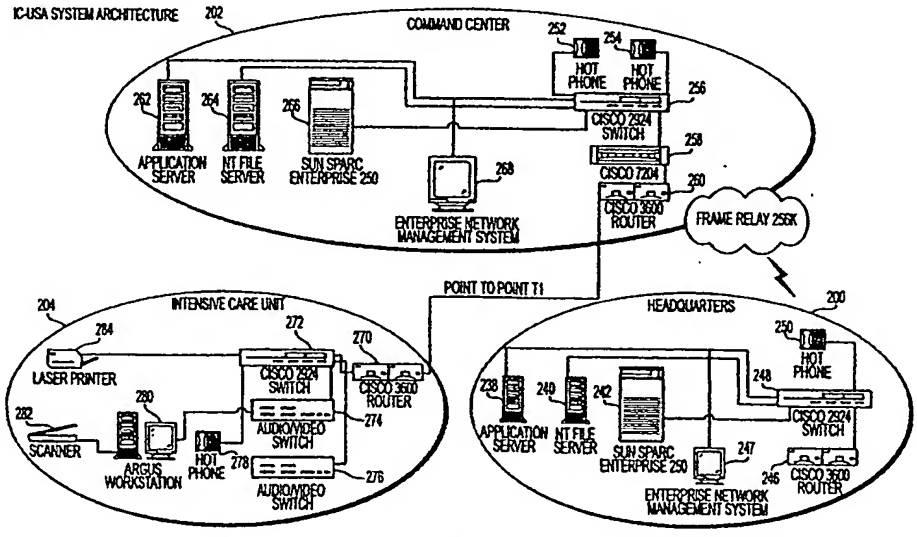
(54) Title: TELEMEDICAL EXPERT SERVICE PROVISION FOR INTENSIVE CARE UNITS




(57) Abstract: A system and method for providing continuous expert network critical care serices from a remote location. A plurality of intensive care units (ICU's) with associated patient monitoring instrumentation is connected over a network to a command center which is manned by intensivists 24 hours a day, 7 days a week. The intensivists are prompted to provide critical care by a standardized series of guideline algorithms for treating a variety of critical care conditions. Intensivists monitor the progress of individual patients at remote intensive care units. A smart alarm system provides alarms to the intensivists to alert the intensivists

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B. FIELDS SEARCHED

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Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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[X] Further documents are listed in the continuation of box C.

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